15. Several such apparatuses (as stated in Claim 1) may be incorporated into a vehicle to heat each glass surface individually.

16. Optionally, more than one source (as stated in Claim 4) and subsequent air ducts may be added to accommodate the environment.

Field of the Invention

The present invention is directed to an apparatus and method for directing airflow to a target surface or substantially enclosed volume. The present invention generally comprises a defroster, deicer or dehumidifier device for any target surface including windshields, other glass surfaces exposed to temperature gradients. The present invention comprises of a series of apertures that circumscribe a windshield or window and blanket the target surface with air. In another embodiment, the present invention may also be used as a diffuser to distribute air or gas to a substantially enclosed volume. For example, the apparatus may be used to distribute heated air in an egg hatchery, or to increase air flow for animal cage enclosures.

Background of the Invention

Sudden changes or cold weather may cause the humidity to rise and fog glass enclosures or other surfaces. The effect of fogging is most recognizable in vehicles such as aircraft, watercraft, automobiles, and the like. Visibility may be reduced which may result in hazardous driving conditions. This condition is especially dangerous when maneuvering around other vessels or vehicles.

Condensation, fogging and icing are persistent problems for aircraft, watercraft, automobiles, trains, residential and commercial buildings, and all other devices that incorporate glass surfaces that are exposed to significant ambient air temperature gradients. The condition commonly known as fogging is caused by condensed water vapor collecting on a glass surface due to the difference in temperature between the glass

and the adjacent air. This is a common problem for many types of vehicles (including aircraft, watercraft, and some farm vehicles). The inside temperature of the vehicle often must differ significantly from the outside temperature to maintain proper safety levels.

For example, if the interior temperature is warmer than the outside temperature, the inside surface of the windshield will be cooler than the air inside the vehicle. Air in contact with the inside surface of the windshield will thus cool down through contact with the glass. The cooling of this air reduces its ability to retain moisture, and thus the moisture that is released condenses on the inside surface of the windshield. This same problem is encountered with windows in residential and commercial buildings because of the difference in outside and inside temperature.

Traditional vehicle defroster mechanisms may require an air conditioner which is not available or appropriate for some types of enclosures or vehicles. Often times the solution of one or more electric fans is inadequate if there is inadequate circuitry or electrical feeds.

Several attempts to improve the performance of traditional heater and defroster systems have been made. U.S. Pat. No. 2,304,691, issued to F. C. Hund, discloses a windshield defroster for an aircraft that distributes heated air along all edges of the windshield. Hund '691 teaches a double-pane windshield with the heated air being introduced between the panes of glass.

U.S. Pat. 5,987,216 issued to Krug and Schani discloses a defroster unit which uses engine coolant that radiates heat in reaction to the passing of an electric current through said heating element.

U.S. Pat. No. 5,173,586, issued to Peter N. Gold, discloses an electric heating attachment which frees frozen windshield wipers from the exterior of a vehicle windshield. The Gold

'586 device extends along the bottom of a vehicle windshield and contacts the blade of windshield wipers resting against it.

U.S. Pat. No. 2,718,037, issued to A. R. Lintern, discloses a finned tube heater and defroster unit for a vehicle. Lintern '037 includes a long tube extending beneath the length of a windshield, through which hot liquid from the engine coolant system is passed. The tube comprises a several fins which extend, over which air is blown from one end of the tube. The air is heated as it passes over the finned tube, and the fins direct the air upward against the inside surface of the windshield.

U.S. Pat. No 6,308,770 issued to Shikata et al. discloses a heater exchanger is sandwiched between the partition plates. Further, the heat exchanger is formed by laminating tubes and a fin while the fin is disposed in each main air passage formed between tube walls of the tubes. Each end of the partition plates is opposite to each end of the tubes so that the partition plates are parallel to the tubes. In this way, air flows which respectively have passed from the air first and second passages pass through the heat exchanger without being mixed with each other therein. As a result, the separation characteristics of air flows can be improved.

None of these devices provide an ideal solution to the problem of heating, defrosting, and deicing where there are space concerns. These devices would be too complicated for solving simple air flow.

Description of Figures

FIGURE 1 is a cut-away side elevation view of an exemplary air distribution apparatus in accordance with the present invention.

FIGURE 2 is a top-view of an exemplary air distribution apparatus in accordance with the present invention.

FIGURE 3 is another top-view of an exemplary air distribution apparatus used in a vehicle in accordance with the present invention.

FIGURE 4 is another top-view of an exemplary air distribution apparatus separated from an external air duct in accordance with the present invention.

List of Reference Numerals

1 = Windshield or wall

2 = Warm Air discharge

3 = Apparatus Side Wall

4 = Dashboard or Apparatus support

5 = Window wall

6 = Air Channel

7 = Trunk

8 = Join tab

9 = Air duct

Summary of Invention

Description of Main Embodiment

The typical embodiment of the invention is illustrated in Figure 1 and Figure 2. The apparatus rests on a support 4 that allows clear transport of air. The main embodiment of the apparatus has inflatable air channels 6 which converge onto a trunk 7. The channel has a warm air discharge 2 which directs the air to specific location 1. The channel 6 is tapered to allow the air to disperse evenly to throughout the channel. The warm air discharge 2 has apertures which are spaced to allow unobstructed inflation and allows air to disperse evenly throughout the air channel 6. In one embodiment, a join tab 8 attaches the trunk 7 to an external air duct 9.

Operation of Main Embodiment

Warm, cool, or neutral air from an external source flows into the duct **9** and travels through the trunk **7**. In one embodiment, the velocity and heat is controlled from the external source. At the trunk **7**, air diverts to the air channels **3**. The channels inflate **3** and air flows through the warm air discharge **2** to the surface **1** which requires defrosting, deicing or continual passive air.

Alternative embodiments

With reference to FIGS. 1 and 2, other embodiments of the invention may be described. Although this detailed description is directed toward the device as installed on the windshield of a boat, it is understood that the device is useful on any other type of vehicle that has target surfaces to allow an operator to see out, such aircraft, watercraft, and trains. It is also understood that the device may be used on surfaces other than windshields, such as side windows and rear windows. Moreover, the device may be used on commercial and residential buildings to maintain windows that are free from ice, fog, frost or condensation.

Additionally, it is understood the device may be used for air distribution in a substantially enclosed volume. For example, the invention may be used to increase circulation to enclosed areas such as animal cages or plant nurseries.

Several apparatuses may daisy chain together from multiple heat sources. Several such apparatuses may be incorporated into a vehicle to heat each surface individually. The trunk may be made of plastic molded plastic, air duct, of vinyl, rip-stop, or other heat resistant material. The air channels may be made of molded plastic, plastic air duct, of vinyl, rip-stop, or other heat resistant material. The air channels may vary in length to accommodate the actual surface.

Each of the channels may feature numerous outlets that disperse unheated or hot air the surface. Alternately a wire mesh, or punch hole or other design may be used place of the warm air discharge. Each of the air channels may feature numerous outlets that disperse unheated or hot air onto the glass surface. Optionally one or more air channels may include an air flow director to block or limit air flow to a particular area of the surface.

The apparatus may be held in place by it's effective air-weight or secured to prevent slippage during operation. Additionally, one or more warm air discharges may be added to control air flow. Optionally, more than one source and subsequent air ducts may be added to accommodate the environment.